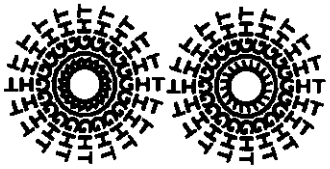


ENERGY-EFFICIENT LIGHTING PROGRAMME FOR BRAZILIAN HOUSEHOLDS

Gilberto De Martino Jannuzzi
Universidade Estadual de Campinas
Brazil

Marcello Moura Campos Fo.
Companhia Paulista de Forca e Luz
Brazil

SUMMARY

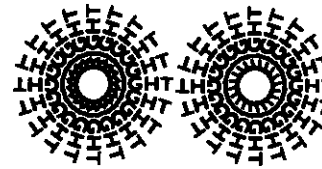
This paper reports the main findings of a pilot lamp-replacement programme done in a Brazilian town. It had he objective to test the consumer response to such initiatives, measure demand savings and evaluate the cost and benefits of the substitution for the electrical utility. Individual measurements were made in a smaller sample of households.
The town selected represents the average Brazilian town with respect to the residential electricity demand patterns.

INTRODUCTION

Traditionally residential consumers in Brazil have not received much attention from electrical utilities for energy efficient lighting programmes. Residential electricity consumption represents about 20-35% of yearly electricity sales of many Brazilian utilities and respond for a significant share of the evening peak demand. Incandescent lighting is still predominant and represents a large economical potential for electricity savings.

THE EXPERIMENT

An experiment with 400 circular fluorescent lamps with electronic ballasts was devised. The aim was the substitution of incandescent lamps of 60 W and 100 W for fluorescent lamps of 22 W and 32 W with similar light output.



These lamps were used in the households kitchens, where in a previous field study it was determined to be the place were lighting was used most and with large coincidence rate with the system peak. Laboratory monitoring was also performed on 20 of the fluorescent lamps in order to test the lamp light depreciation, harmonic emissions, lifetime and power factor of the equipment.

A stratified sample was selected according to monthly consumption levels and visits were made to explain the experiment and invite the consumers to participate. Only consumers with incandescent lamps in their kitchens were allowed to participate, and also other technical requirements were also observed. The participating consumers responded a first questionnaire describing their lighting patterns. The fluorescent lamps were installed by the utility and were donated to the consumers. A smaller sample of 40 households was selected and individual metering was performed on the new lamp. The objective of this metering was to measure more precisely the time when lamps were actually used over the period of one week.

Initially 760 households were selected but only 375 satisfied the required conditions or were willing to participate. We found a very low percentage of fluorescent lighting in the town selected for the experiment (Cosmopolis, a town with about 30,000 people in the State of Sao Paulo).

RESULTS

Lighting patterns

It was found that only 3% of the sample had more than one lamp point (and one lamp) in the kitchen. About 55% of households use one incandescent of 60 W, and 38% use one 100 W. Luminaries are used by only 27% of households.

According to the questionnaires lamps are more used during the period of 6 pm to 21 pm, having a maximum utilization rate between 7 and 8 pm, as can be seen from Fig. 1. Individual measurements made directly on the lamp point indicate an instantaneous maximum coincidence rate of 67% at peak hours. The total operating time per lamp was 3,9 hours with a standard deviation of 1,1 hour.

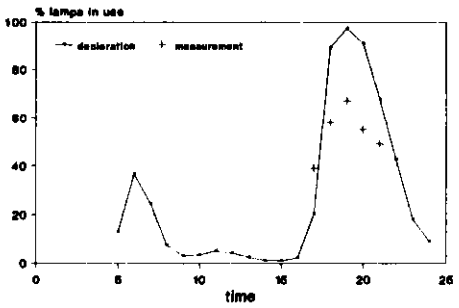


Figure 1 Lamp usage patterns: consumers declarations and measurements

The fluorescent lamp acceptance

No resistance to the new lamp was detected. About 88% of households declared that they considered the lamp better than the one previously used. Improved lighting level was the main factor considered.

The positive reaction to the new lamp can also be seen by the declared intention of installing more fluorescent lamps in the remaining rooms.

Nearly 80% of households did not know the price of the fluorescent lamp as compared to the incandescent. When informed its cost, 22% declared that they would not buy the lamp.

The cost-benefit analysis of the substitution

The estimated cost of conserved electricity by using a 22 W fluorescent lamp replacing a 60 W bulb is US$ 0,06/Kwh, if the utility pays the full costs of the substitution.. In the case of the 32 W lamp the cost is US$ 0,03/kWh. These are the direct costs to the utility. For the case of the particular utility involved these costs are extremely attractive since they pay US$ 0,255/kWh to their supplier for electricity at peak hours. As can be seen from Fig. 2, the utility has net benefits even when subsidize the full cost of the fluorescent lamp to residential customers.

Analyzing from the perspective of the consumer, there is not benefit at present tariffs and full equipment costs. A minimum of 70% reduction in the equipment cost is required in order to achieve an annual positive benefit.

The costs to avoid a peak kW to the utility are US$ 886/kW for the case of the 22 W fluorescent and US$ 495/kW for the 32 W. These costs are very competitive with the present costs of new installed capacity in Brazil (which range from US$ 1,800 to US$ 3,000).

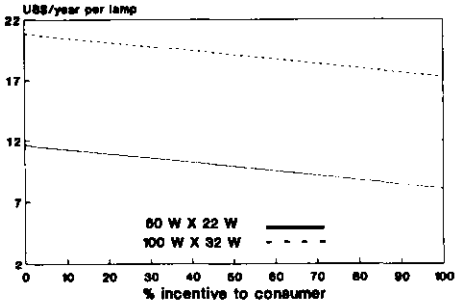


Figure 2 Annual benefits to the utility with lamp replacement

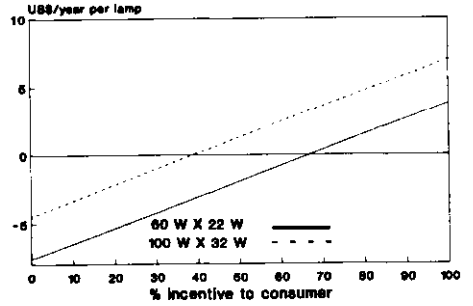


Figure 3 Annual benefits to the consumer with lamp replacement

CONCLUSIONS

The results of this experiment indicate that the utility can expand the program with economic returns. Based on the results achieved a much larger programme (about 90,000) is being implemented in other regions of the State of Sao Paulo and other utilities have started similar programmes in Brazil.